Separations and Actinide Science Signature Activity Roadmap

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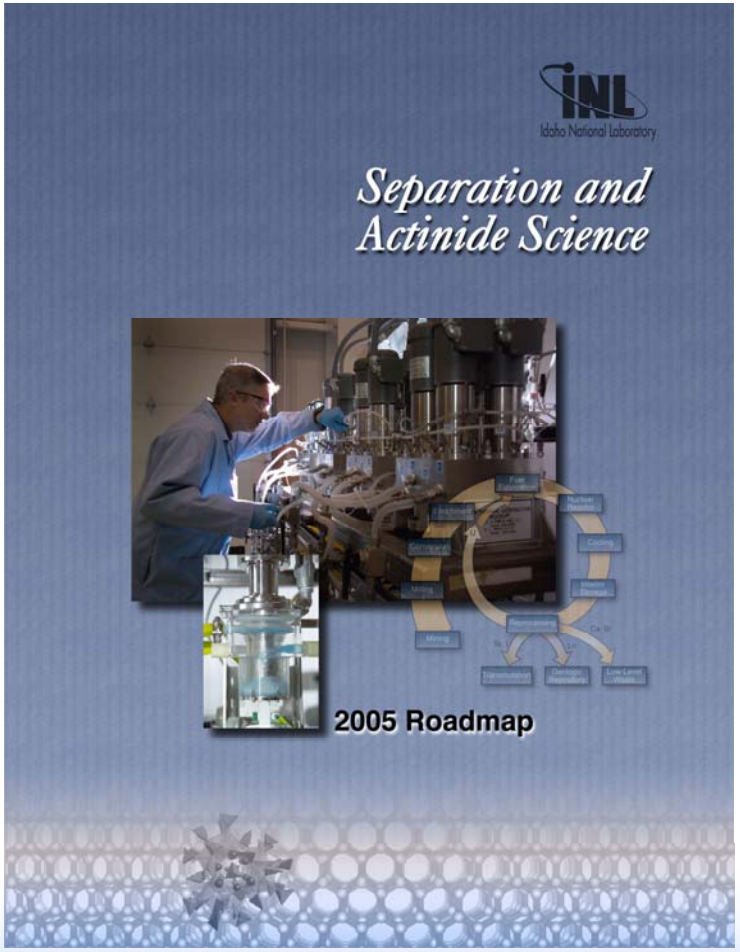
Goal of the Separations and Actinide Science Signature

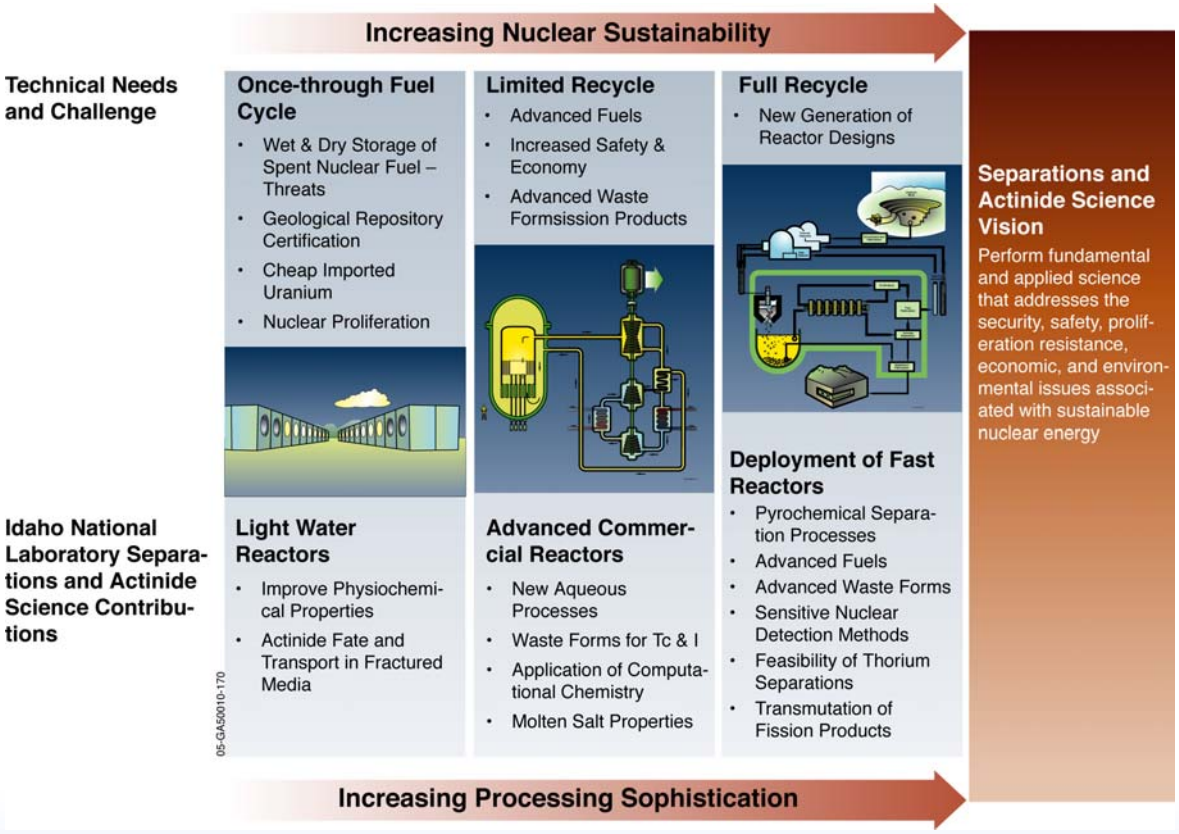
- **Establish a nuclear technology science base to:**
  - **Underpin the development of an advanced fuel cycle**
  - **Provide inherently safe high-temperature nuclear fuels**
  - **Eliminate the potential production of nuclear weapons through reprocessing of spent fuel**
  - **Permit environmentally safe Management of associated waste**



Why Create this Signature?

- What was done in the past is not acceptable
  - Long-term Storage of Spent Nuclear Fuel Growing issue and represents terrorist risk
  - PUREX Reprocessing Presents Proliferation Risk
  - Better Data Needed for Certification of Repository
- New Reactor Designs Require Advanced Ceramic Fuels
- New Waste Forms Need to be Certified
- Desire to Reduce Environmental Impact of Nuclear Technology Drives New Process Development

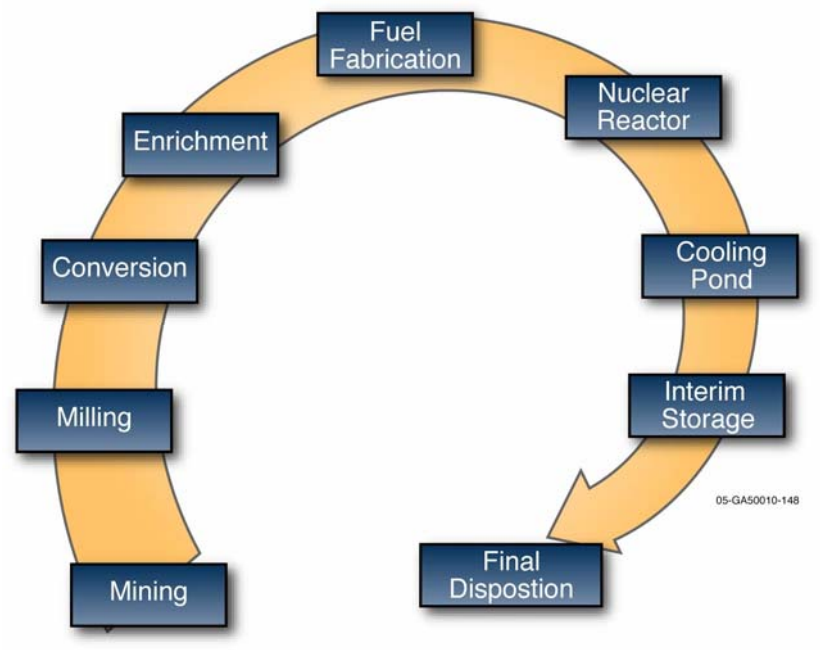
The Challenges to Separations Technology and Relevant Actinide Science related to Nuclear Technology Development



Specific Challenges

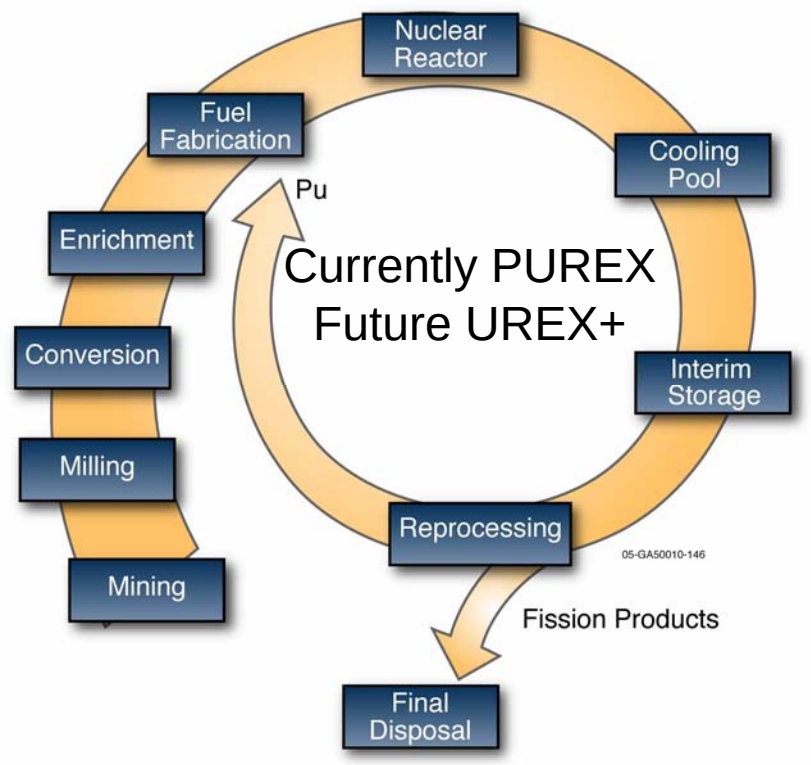
- Once-through Fuel Cycle
- Limited Recycle
- UREX+ Aqueous Process
- Closed Fuel Cycle
- Implementation of Pyrochemical Fuel Reprocessing
- Alternate Fuel Cycles
- Fuel Cycle Safe Guards

Once-through Fuel Cycle

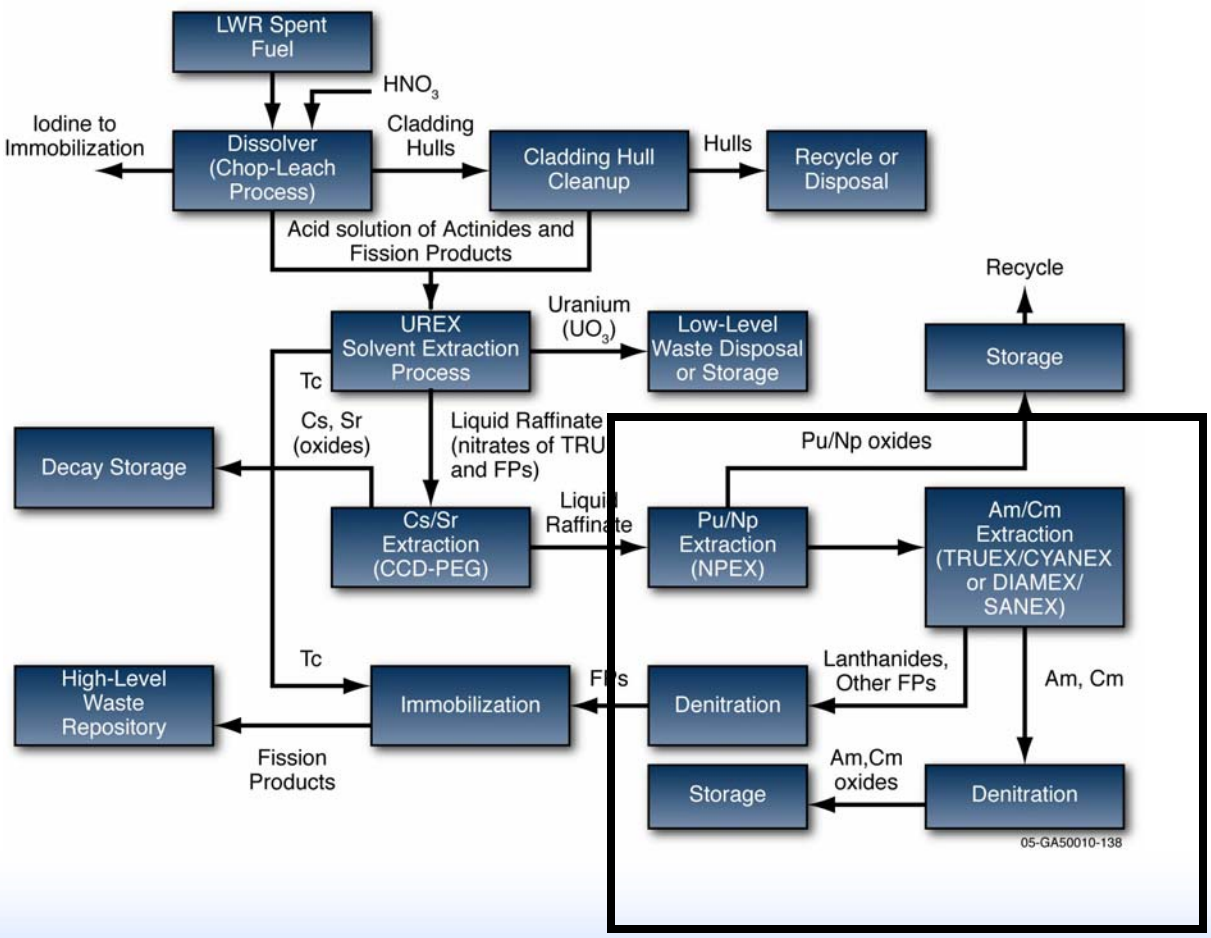


77,000 metric Tons (2010)

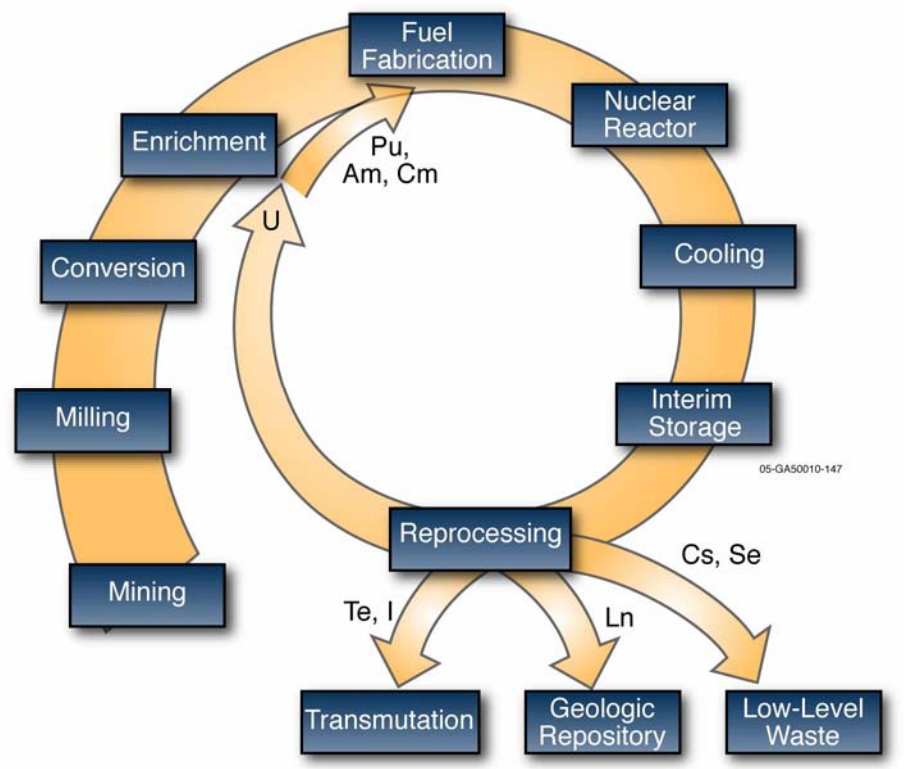
Limited Recycle



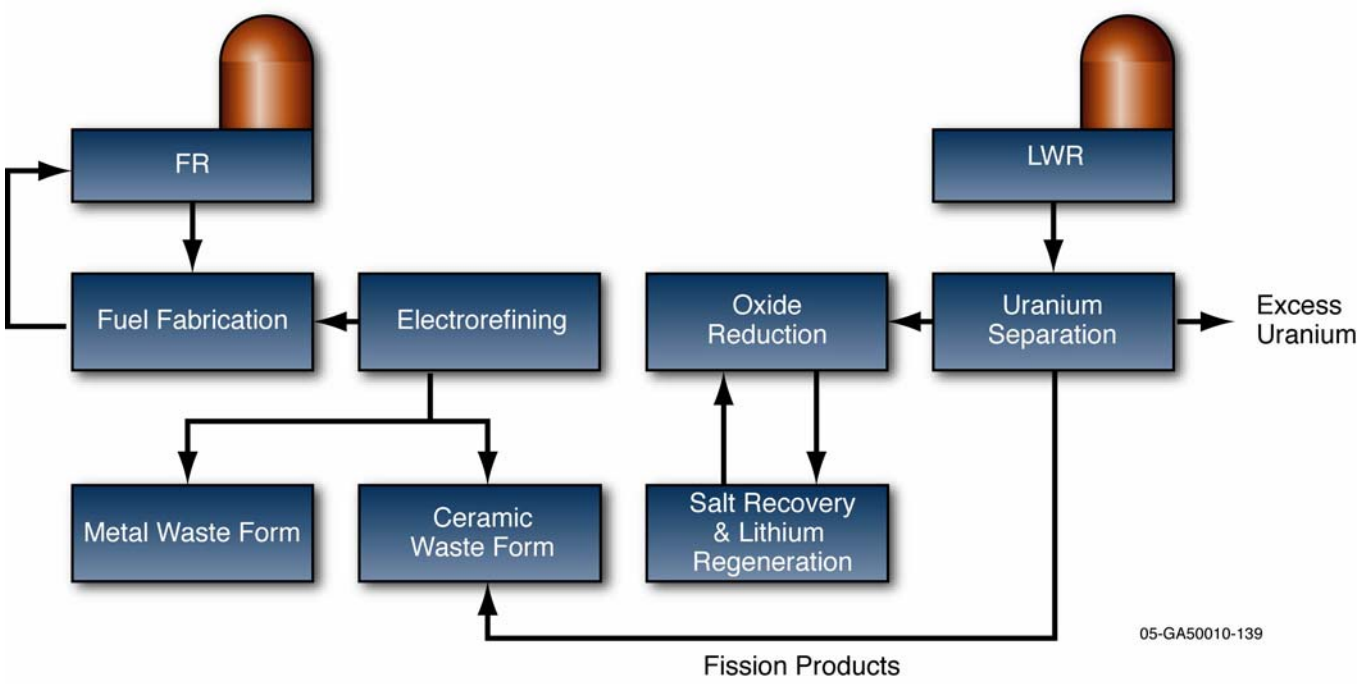
Uranium Extraction Process (UREX)



Full Recycle with Repository Optimization



Combined UREX and Pyrochemical Reprocessing



Path Forward